Navigate

Turn and Talk

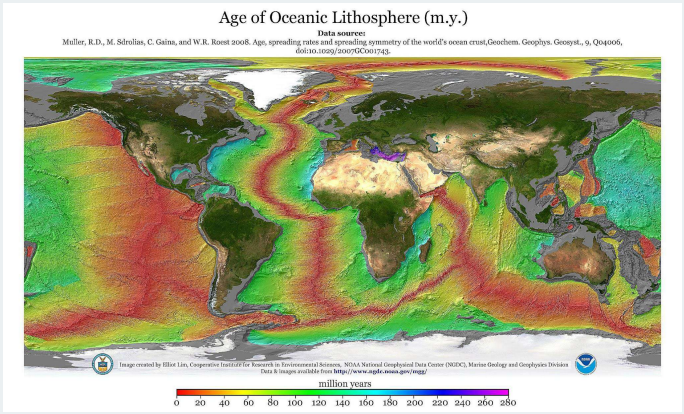
- What does it tell us if the rock in the Afar region is the same age as most of the rock everywhere else?
- What if the rock in the Afar region is younger than everywhere else?

→ Be ready to share your ideas with the class.

Look at Data

With a partner

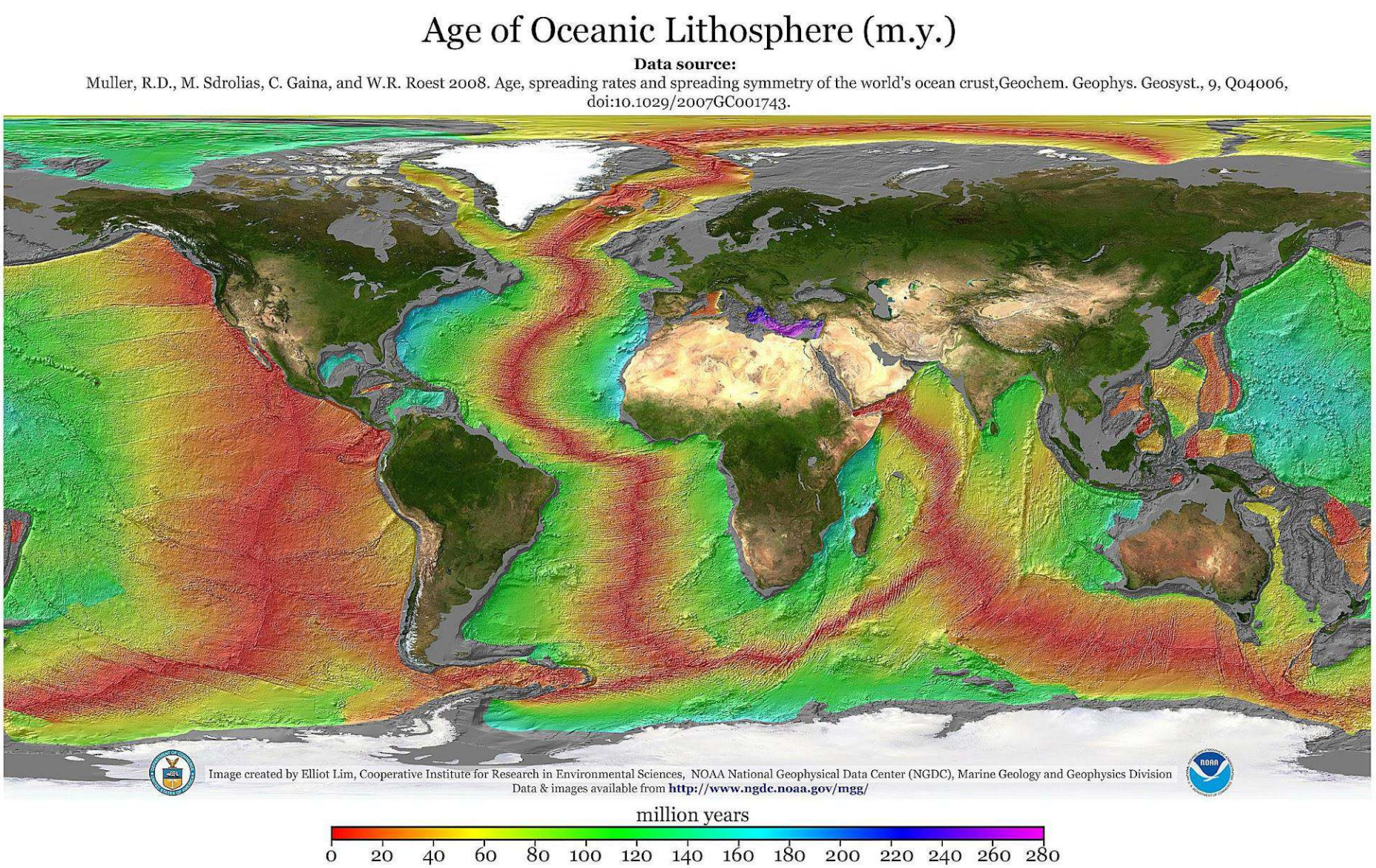
- Look at the maps showing the age of rocks on the continents and in the oceans.
- Keep track of what you notice and wonder.



➔ Be ready to share your ideas with the class.

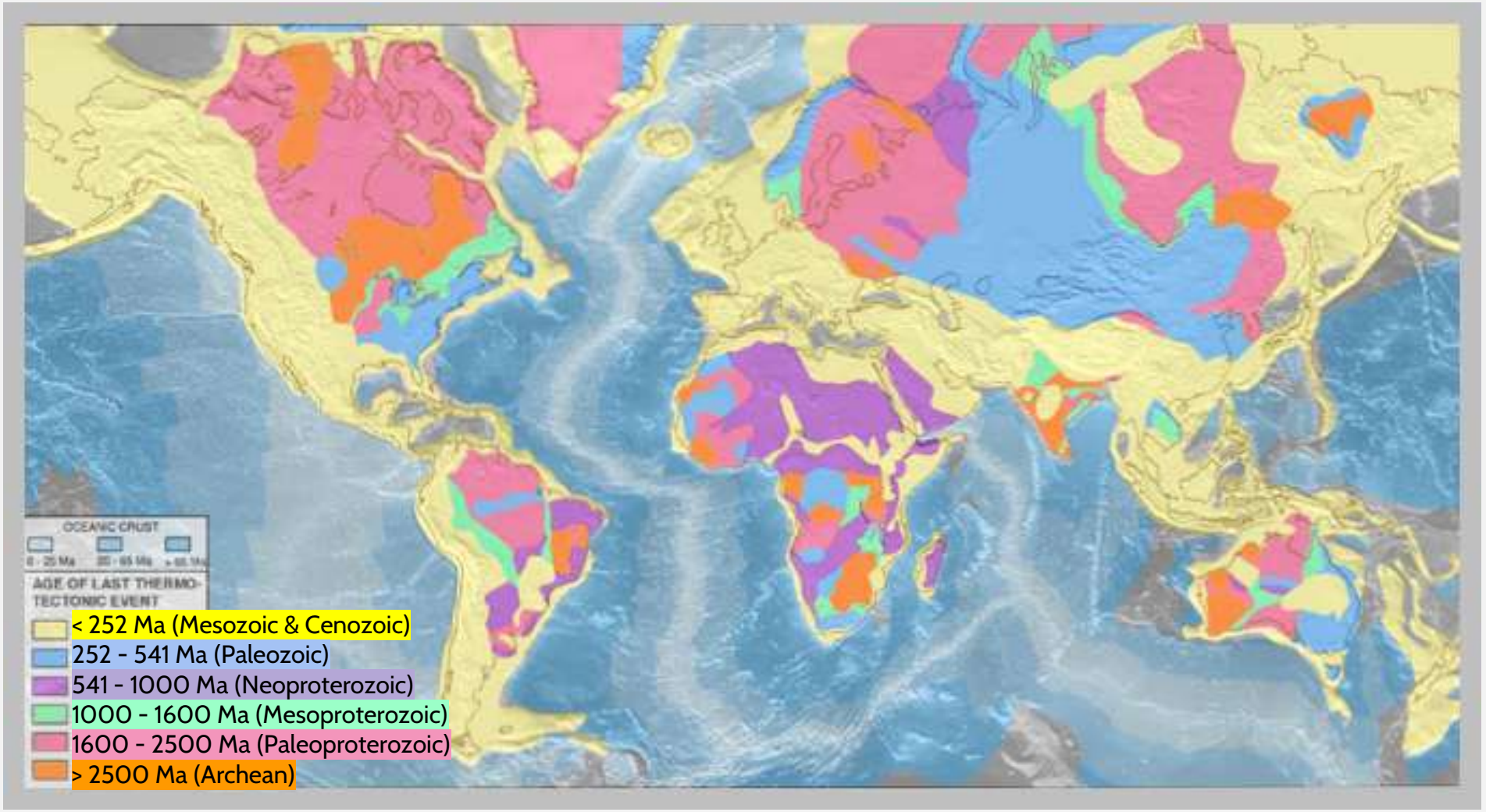
Slide C

Ages of Ocean Rocks



Slide D

Ages of Continental Rocks



Make Inferences from Observations

Turn and Talk

What might be happening to create these patterns?

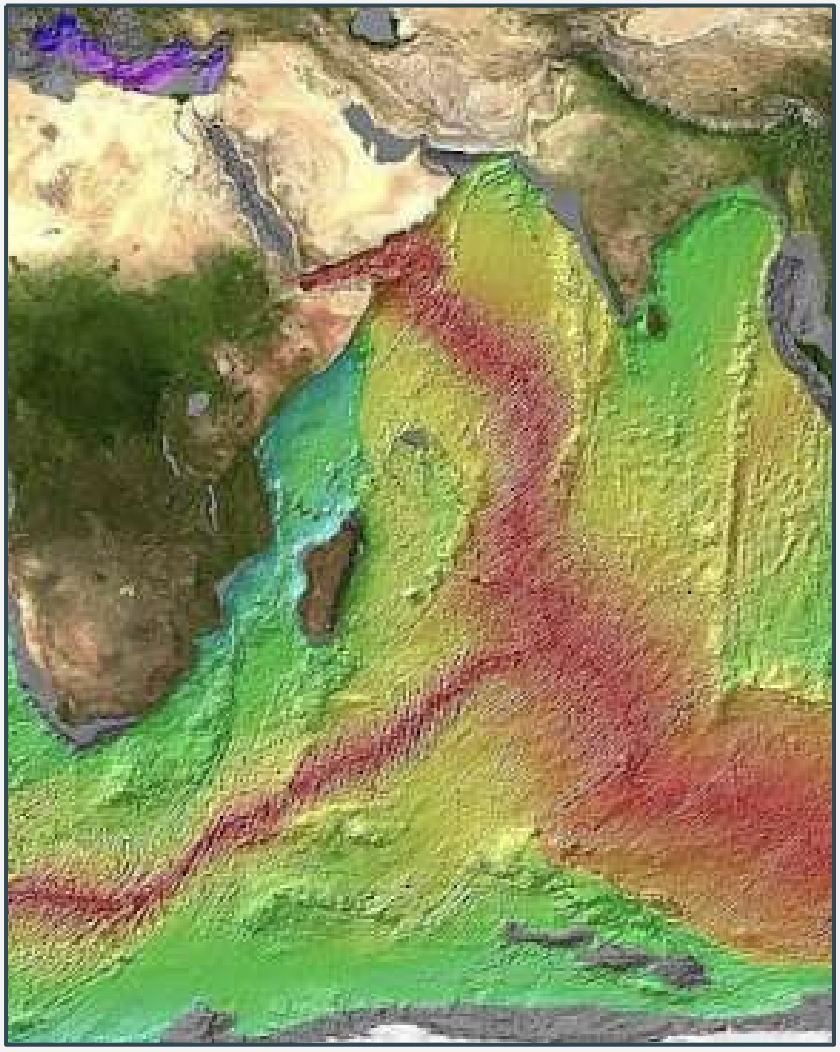
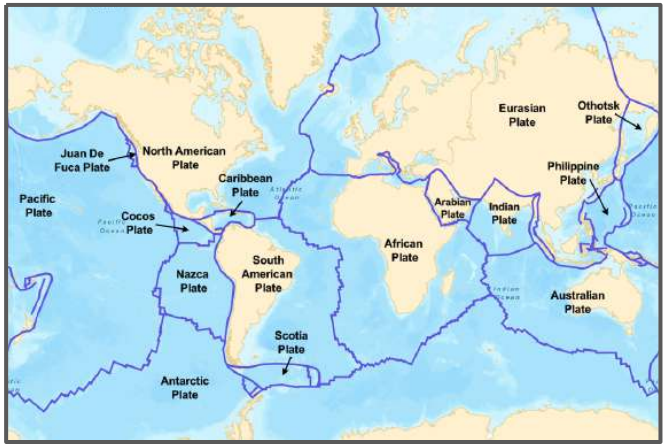
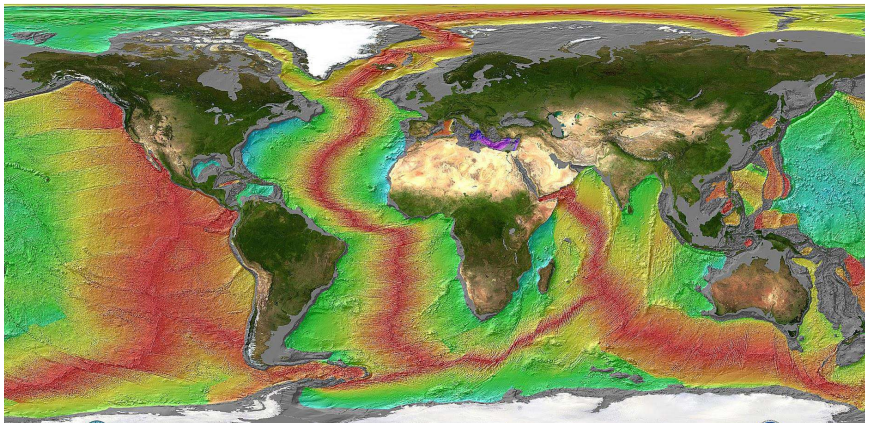


Plate Boundaries

With your class

What do you notice about the relationship between these lines in the ocean and the tectonic plates?



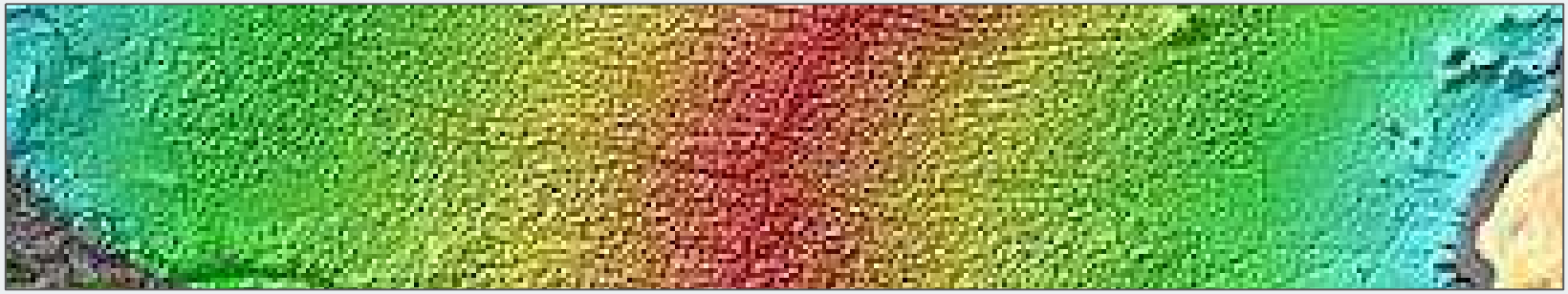


Model the Formation of Ocean Crust

With your class

Use materials in the classroom to model the creation of oceanic crust at a plate boundary in the ocean.

Can we re-create the gradient pattern we noticed?



Model the Formation of Ocean Crust

With your class

Make an initial class consensus model based on your observations to explain how crust might be created at plate boundaries in the ocean.

Trace Matter in the System

With your class

- What did the model tell us about what was happening to the matter in the system?
- Where was the matter coming from, exactly? What evidence do we have for this from previous lessons?
- What state was the matter in? What evidence do we have for this from previous lessons?
- What would we see if we could “rewind” this model backward? Would the whole crust get sucked back into this crack?

Forces and Energy Transfer

With your class

What are the unbalanced forces in the system that could be responsible for the motion of the matter?

Navigate

Stop and Jot

- How might the young rock we see in the oceans and in the Afar region be different from older continental rock?
- How could that help us make progress on our questions about the Afar region?

Navigate

Turn and Talk

- What can we learn from samples of oceanic and continental crust?
- What could this tell us about the Afar region?

Make Initial Observations of Rock Samples

With your class

- What do you notice about each sample?
- What could we test or observe that could help us understand how each might interact with other parts of the crust or rigid mantle?

Granite (continental)

Basalt (oceanic)

Plan an Investigation

With your class

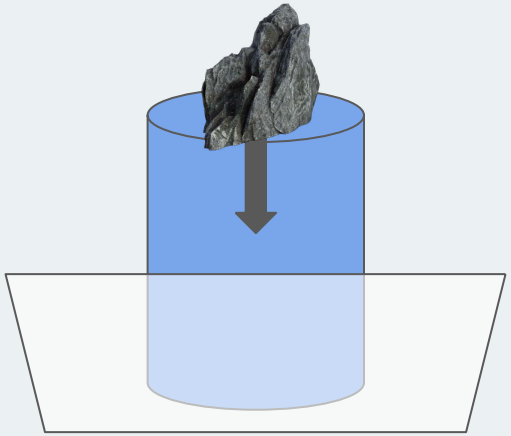
Density = mass per volume

How can we find the volume of an irregular shape?

Conduct the Investigation

With your group

Use your tools to collect data for each of your 2 rock samples.



Share Findings and Discuss Implications

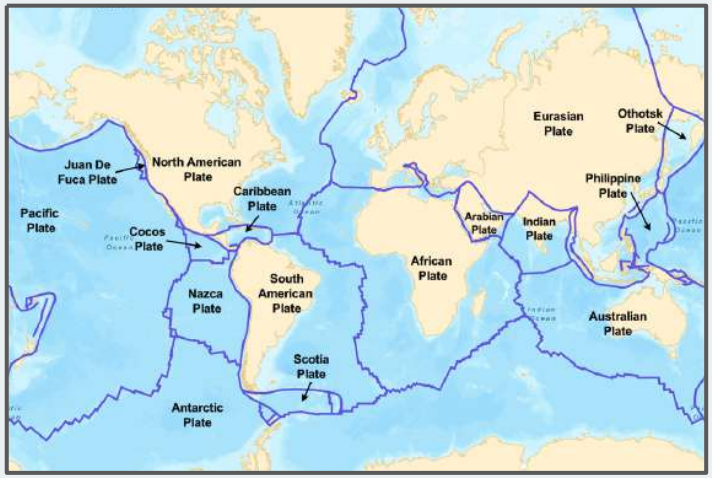
With your class

- Which rock was more dense?
- How did you figure that out?

Share Findings and Discuss Implications

With your class

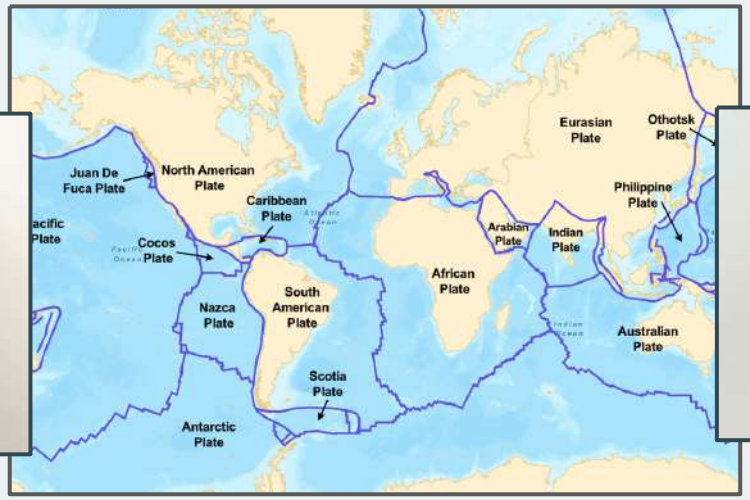
- Why would dense, new rock be forming where these 2 plates are in contact?
- Could this be happening at every plate boundary (where 2 plates are in contact)?



Share Findings and Discuss Implications

Turn and Talk

How might the different densities of these rocks affect what is happening at those boundaries?



Share Findings and Discuss Implications

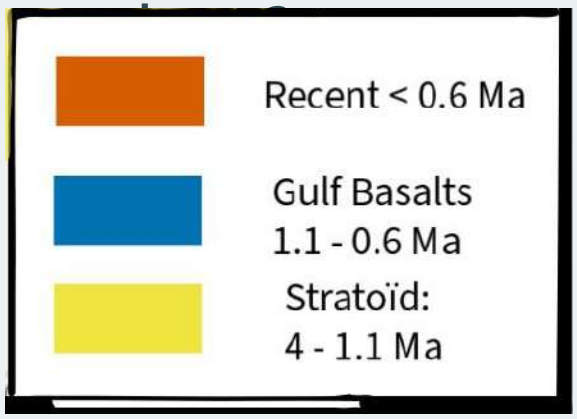
With your class

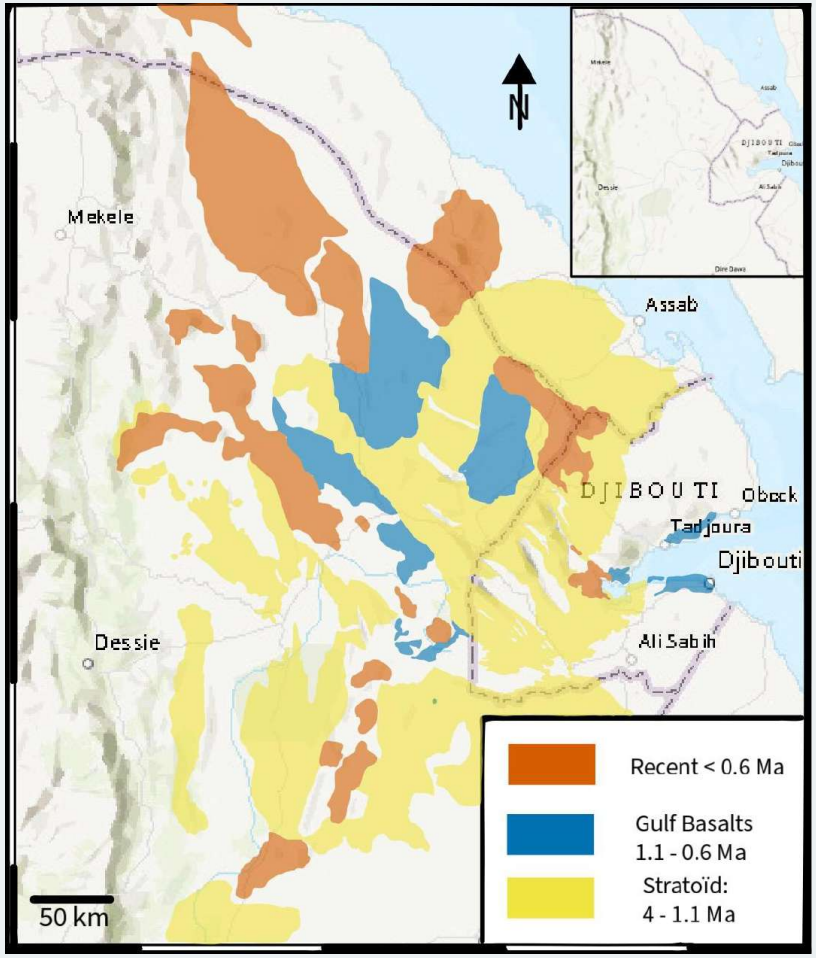
- What do we know about the crust in the Afar region?
- What might that mean about what's happening in the Afar region, based on our model?

Share Findings and Discuss Implications

Stop and Jot

If the crust in the Afar region is basalt, does that mean a new ocean is forming





Fill Out the Progress Tracker

On your own

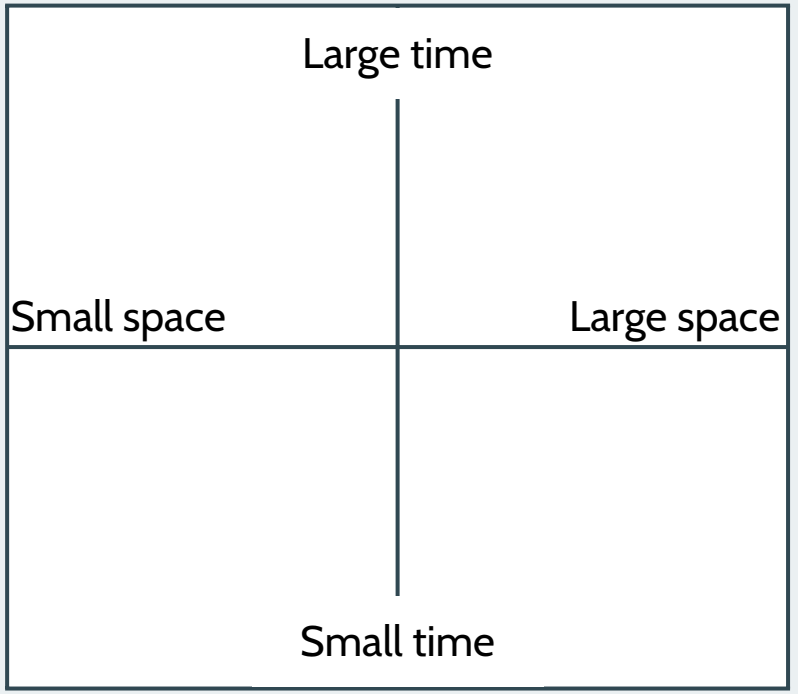
Update your Progress Tracker in your science notebook.

Lesson #	What did you figure out?	Which of these lenses did you use to figure this out?	How did using these lenses help you figure this out?
9		❑ Stability over time ❑ Change over time ❑ Thinking at/across different scales	

Revisit the Scale Chart Poster

With your class

What new phenomenon did we explore in this lesson that we need to add to our Scale Chart poster?



Add Questions to Our DQB

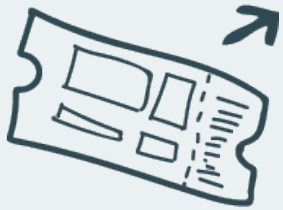
On your own

Take a moment to look at our model for new crust in oceans. Jot down any new questions you have about plate boundaries, crust, and forces in the Afar region.

With your class

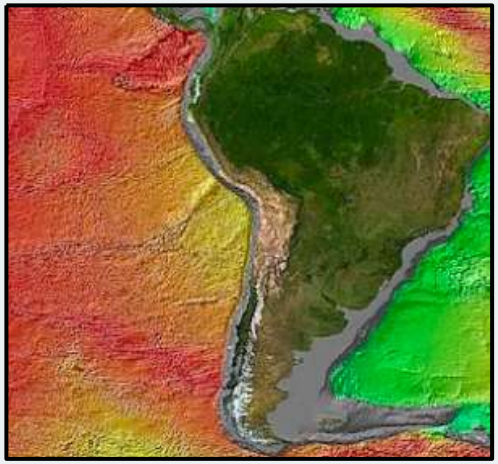
Create a new cluster on the DQB for your questions.

Navigate: Exit Ticket



On your own

What do you think might be happening at the places where continental and oceanic crust meet up? Why do you think that?



Additional Image Credits

Oceanic lithosphere age map: Image created by Elliot Lim, Cooperative Institute for Research in Environmental Sciences, NOAA National Geophysical Data Center Marine Geology and Geophysics Division

Continental rocks age map: U.S. Geological Survey

Irregularly shaped rock: Jazella, Pixabay

Graduated cylinder: Eric Kimsey, Pixabay

Tectonic plate map: Esri, FAO, NOAA | Sources: Esri; Global Mapping International; U.S. Central Intelligence Agency (The World Factbook) | USGS, Esri Training Services - for educational purposes only

Basalt age in the Afar region map:

Data: Stab, Martin & Bellahsen, Nicolas & Pik, Raphaël & Quidelleur, Xavier & Leroy, Sylvie. (2015). Modes of rifting in magma-rich settings: Tectono-magmatic evolution of Central Afar. Tectonics. 35. 10.1002/2015TC003893.

Underlying map: Esri, HERE, Garmin, USGS, EPA

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